

SECTION 41 2213.13

BRIDGE CRANES

LANL MASTER SPECIFICATION

When editing to suit project, author shall add job-specific requirements and delete only those portions that in no way apply to the activity (e.g., a component that does not apply). To seek a variance from applicable requirements, contact the ESM Mechanical/Structural POC.

When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General Requirements.

Delete information within "stars" during editing.

Specification developed for ML-3 projects. For ML-1 / ML-2, additional requirements and QA reviews are required.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Provide, install and test a top running overhead bridge crane.

1.2 DESCRIPTION

- A. Provide a [] -Ton CMAA Service Class [D] Bridge Crane.

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01 3300, Submittal Procedures:

1. Certificates:

- a. Certification of previous crane installations, including name and address of project and owner.
- b. Certifications for structural steel, fasteners, hooks, wire rope, forgings and castings.
- c. Certifications for all electrical and mechanical components stating manufacturer and type.
- d. Certification of required inspection and load testing.
- e. Welder certifications for all welders who will perform work on the crane system. Certify welders in accordance with AWS.

2. Manufacturer's installation instructions.

3. Performance Data: Provide Quality Assurance Plan in accordance with PART 3, Section 3.5.

4. Shop drawings:
 - a. Structural steel fabrication drawings showing structural members and their connections.
 - b. Crane arrangement drawings (Plans, Sections and Elevations) showing the location of structural members, bridge and trolley equipment, travel of hook and work platforms. Include clearances, lifting lengths, maximum crane wheel loads and simultaneous trolley wheel loads.
 - c. Bridge, bridge drive and hoist arrangement drawings (Plans, Section and Elevations) showing the arrangement of the bridge, bridge drive, and hoist. Include equipment (gears, shafts, wheels, couplings, bearings, drum, blocks, rope reeving, framing, festooned conductors, trolleys, brakes, and machinery) dimensions and weight. Also, include description (as applicable, rating for horsepower, time, rpm, temperature, torque, amperes, current characteristics, model and size number) of motors couplings, brakes, limit switches, and similar parts.
 - d. Electrical drawings of the electrical equipment and wiring diagrams, showing and identifying electrical equipment and schematically showing connections and interconnections of panels and equipment. Include manufacturer's name, model number and rating. Also, include hook-speed/hook-load curves (hoisting and lowering) or motor-speed/ torque and current curves for controllers for hoist motor, and motor-speed/ torque and current curves for controllers for trolley and bridge travel.
5. Operation and maintenance data indicating the following:
 - a. Name, address and telephone number of nearest authorized service facilities and parts distributor.
 - b. Parts lists.
 - c. Recommended spare parts.
 - d. Lubrication requirements and list of lubricants including acceptable substitutes.
 - e. Maintenance requirements and schedules for all equipment.
 - f. Safety procedures.
 - g. Proper operation of all equipment.
 - h. Routine maintenance procedures.
 - i. Assembly drawings and descriptive literature.
 - j. Wiring schematics.
6. Written 24 month parts and labor warranty. Repair or replace defective materials and workmanship of the crane during the warranty period. The warranty will begin at the time of final acceptance of the installation by LANL.
 - a. Defective Material and Workmanship is defined to include:
 - Performance below required minimums.
 - Abnormal wear considering intensity of use.

- Systems that are not maintainable or accessible for required maintenance.
- Unsafe conditions.
- Counterfeit parts.

1.4 QUALITY ASSURANCE

- A. Design and fabricate bridge crane in accordance with the recommendations of ANSI B30.20, CMAA Specification No. 70, OSHA 29 CFR Part 1910, NEC (NFPA 70), Article 610, and the requirements specified herein.
- B. Manufacturer's Qualifications: A firm regularly engaged in the manufacture of major components for cranes of the type specified for this project. The new assembly will duplicate equipment that has been in satisfactory use for a period of at least 3 years.
- C. The installer will be a manufacturer's representative having experience installing the type of equipment supplied.
- D. Temporary use of the crane for construction purposes or during the construction period will not be permitted without written permission from LANL. In the event permission is given, the Contractor will assume full responsibility for protection and maintenance of equipment. All hoisting equipment used in this fashion will be fully load tested, inspected, and accepted by LANL as a fully functional unit prior to use. Expense for this testing will be paid for by the Contractor. Hoisting equipment will be fully inspected after temporary use period has ended. Equipment damaged or worn beyond use will be replaced by the Contractor. Preventative maintenance required by the equipment manufacturer during this temporary use period will be performed and paid for by the contractor.

PART 2 PRODUCTS

2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

- A. Comply with Section 01 2500, Substitution Procedures.

2.2 MATERIALS AND CONSTRUCTION

- A. Manufacturers:
 - 1. Harnischfeger P&H.
 - 2. Whiting Corp.
 - 3. Acco/Wright.

- B. The crane will be located [] inside a building] at an altitude of [7500] feet above sea level with [15] degree F minimum, [65]degree F normal, and [100]degree F maximum temperatures, [free from dust, moisture, corrosive fumes]. The crane will be operated by [LANL technicians and not by skilled crane operators].
- C. Operational Requirements:
1. Rated Load:
 - a. Main Hoist: [] tons.
 - b. Auxiliary Hoist [] tons.
 2. Approximate Span: [] feet [] inches.
 3. Required hook lift:
 - a. Main Hoist: [] feet [] inches.
 - b. Auxiliary Hoist: [] feet [] inches.
 4. Approximate length of Runway: [] feet [] inches.
 5. Service Information: CMAA Service Class [].
 6. Travel Speeds:
 - a. Main hoist [] fpm maximum.
Control: variable frequency, stepless.
 - b. Auxillary hoist [] fpm maximum.
Control: variable frequency, stepless.
 - c. Bridge [] fpm maximum.
Control: variable frequency, stepless.
 - d. Trolley [] fpm maximum.
Control: variable frequency, stepless.
 7. Hoist Coverage:
 - a. Provide for coverage of floor area, except for coverage within [] from building side walls and [] from end walls.
- D. General Requirements:
1. Arrange mechanical and electrical equipment on the bridge to permit easy and convenient access to all components requiring periodic maintenance, replacement or adjustment from the work platform.
 2. Provide moving parts, shafts, etc., with covers to guard against accidental injury or risk of injury to the operator in accordance with OSHA. Install hinged and hatched protective covers in such a manner as to simplify access to the covered parts for maintenance and repair.

3. Clean and paint with 1 coat (1.5 mil) of primer and 2 finish coats (3.0 mil) exposed metal surfaces, except contact surfaces between moving parts, wire rope and hook(s). Use manufacturer's standard paint. Touch-up all damaged areas after installation with same brand and color of paint.
4. On underside of bridge crane paint directional arrows to correspond to the labeling of push buttons on the pendant control. Paint directional arrows with a size (6 inch minimum), style, and color to be visible from any position of the control pendant.
5. Provide a motion warning system consisting of a pulsating horn and signal lights. Control the horn at the pendant controller with "hold-to-operate" type control. Mount blue rotating beacon lights in a prominent location on the bridge and trolley to signal when the crane is in motion. The signal lights shall remain on when crane is in operation.
6. Do not use lead based paint.
7. Do not use asbestos in brakes or any other component.

E. Structural Requirements:

1. Provide structural steel conforming to the requirements of ASTM A36 or other types of steel as selected by the manufacturer and approved by LANL.
2. Provide high strength bolts conforming to ASTM A325.
3. Provide welding designs and procedures that conform to AWS D14.1, Specification for Welding Industrial and Mill Cranes, with the exception of Section 705, which will be in accordance with crane and manufacturers standard tolerances for deviation from specified camber and sweep.
4. Design girders to carry the full rated load of the crane without undue vertical or lateral deflection or vibration in accordance with requirements of CMAA 70.
 - a. Provide bridge crane consist of 2 girders carried by end trucks. Provide girders of welded construction with built-up box section or reinforced wide flange beams.
 - b. Notch girder at each end and install seat welded to the girder to provide a connection to end trucks. Connect end trucks with high strength bolts to prevent crane skewing on the tracks.
 - c. Provide ASCE standard rails. Fasten or weld rails to top member of each girder to provide a track for the trolley. Weld steel stops near the end of each girder to engage bumpers on the trolley to prevent it leaving the bridge.

5. Construct end truck of structural steel sections and steel plates forming a box section, reinforced to provide a rigid structure with openings at each end for mounting of truck wheels. Precision bore end trucks to provide accurate alignment of wheel bearing assemblies. Provide end truck with a wheel base of a minimum of 1/7 of the span of the bridge. Provide end truck with 1 wheel in each end truck geared for use with the bridge drive. Include as part of the end truck the drive wheels, carries wheels and wheel gear protecting guards. Design the truck so that in case of a wheel or axle failure, the drop of the load will be limited to one inch. Make all end truck to bridge connections with high strength bolts. Provide squaring marks between the bridge girders and end trucks to facilitate erection. Provide end trucks with rubber bumpers on all 4 corners. Provide rail sweeps of rubber or equal on all 4 corners.
6. Provide a trolley frame built up from structural steel sections welded together to form a rigid one-piece frame adequately braced to ensure proper alignment of trolley wheels. Provide trolley end stops with a height equal to or greater than the radius of the trolley wheels. Provide rail sweeps of rubber or equal on trolley frame for sweeping rails in both directions.
7. Install a [36] inch wide work platform and handrails running the full length of the bridge. Mount the platform on the [] side of the bridge. Construct the work platform in accordance with CMAA 70 and OSHA requirements.
8. Provide wire mesh partitions between the toe plate and intermediate rails of the outboard handrails and both end handrails. Construct partitions of 10 gage steel wire panels, woven into 1 1/2 inch diamond mesh. Weld partitions to support members.

F. Mechanical Requirements:

1. Provide stationary type bridge and trolley wheel axles with wheel mounted midway between axle bearings. Provide wheel axles with mounting nuts for bearing adjustment. Design wheel mounting so that an axle wheel can be removed without disturbing other truck elements or their alignment.
2. Provide double flange type steel bridge and trolley wheels with treads hardened to 275 brinell. Provide drive wheels with a tolerance of 0.01 inches between wheel diameters.
3. Provide bridge end truck unit drives that are totally enclosed with all gearing operating in oil-tight casing. Provide horizontally split gear cases. Provide bridge drive consisting of individual electric motor driving gear reduction units direct coupled to driving wheel in the end trucks. Provide bridge drive units with a brake and controlled from pendant control.
4. Provide trolley drive mechanisms that consist of an electric motor driving through gear reduction unit flexibly coupled to the trolley drive wheel axles. Gearing, except the final reduction at wheels, shall run in oil or be splash lubricated.

5. Hoisting Machinery:

- a. Provide hoist with a HMI rating of H-3 and capable of holding 150 percent of rated load. Provide hoisting machinery consisting of an electric motor driving through gear reductions to a winding drum. Do not use trolley drive motor as the hoist motor. Mount gears in the reduction unit on short shafts and support gears between bearings. Connect the drum gear to the hub of the rope drum by keyed type connection. Encase gears in oil-tight housing split horizontally and readily accessible for maintenance. Connect hoist motor to the reduction unit with a flexible coupling.
 - b. Provide the rope drum with a running sheave to rope diameter ratio of 24 to 1. Provide idler sheaves of not less than 1/2 the running sheaves.
 - c. Fabricate rope drums of cast iron or steel and properly machined for the cable used.
 - d. Groove the rope drums right and left hand to receive the full run of hoisting cable without overlapping. Provide drums of sufficient size and length so at least 2 turns of wire rope remains on the drum when the hook is in low position.
6. Equip hoists with an overload cutoff device. Provide a non-friction electro-mechanical protective device that permits operation of the hoist(s) within its rated capacity, but prevents lifting loads that could cause damage to a properly maintained hoist. Provide an overload cutoff that is capable of sensing a load greater the 105 percent, (plus 0 percent, minus 5 percent), and interrupts the "up" control circuit and prevent the hoist from raising the load. Operation of the cutoff will automatically reset upon removal of the overload. Do not increase the hoist headroom with overload device. Configure the cutoff to permit easy replacement of the wire rope and permit the use of swaged end rope terminations.
7. Provide bridge brake of shoe type magnetic brake mounted outboard on motor shaft or motor extension shaft. Press on and key the brake wheel to motor shaft. Provide ample clearance for opening of brake and for servicing and removing brake wheel without disturbing motor.
8. Provide hoist with 2 means of braking, a hoist motor brake and a mechanical load brake or suitable method of electrical braking.
- a. Provide mechanical load brake or electric braking systems to automatically regulate the speed during lowering to prevent undue acceleration. Provide load brake capable of holding full load independent of hoist motor brake.
 - b. Provide hoist motor brake of either direct current magnetically operated disc type or shoe type mounted on extended pinion shaft. Provide spring set brake, equally effective in either direction of motor rotation, and sized to stop motor and hold rated capacity load. Design brake to set automatically whenever current to motor is off.

c. The minimum required brake rating are as follows:

<u>Motor</u>	<u>Brake, Rating, Full Load Torque</u>
Hoist	150 percent
Bridge	100 percent
Trolley	50 percent

9. Provide gearing rated by AGMA standards for strength and durability for the service intended. Provide pinions of alloy steel and heat treated.
10. Provide heavy-duty, anti-friction ball or roller type bearings. Select bearings to give a minimum L₁₀ life of 10,000 hours, per AFBMA - 9 based on full rated speed.
11. Provide extra flexible improved plow steel wire rope, manufactured for crane service. Design wire rope to have a safety factor of 5.
12. Provide loadblock with a heavy steel housing to support sheaves and hook. Construct hook of forged steel and support on thrust bearing. Provided hook with safety catch. Provide sheaves of steel having deep flanges and properly grooved to fit wire rope. Enclose sheaves by steel housing.
13. Provide sealed gear enclosures with lubrication so gears operate in a oil bath that provides positive splash lubrication for gears and gear bearings. Provide lifetime lubrications for bearings in axle, sheaves and drum shaft.

G. Electrical Requirements:

1. Provide 480 volt, 3 phase, 60 hertz electrical power for crane motors. Provide 120 volt, single phase, 60 hertz control power or other lower voltages approved by LANL.
2. Design, assemble, test, and install electrical equipment and wiring in accordance with the requirements of NEC (NFPA 70), Article 610.
3. Supply power to the bridge, trolley and hoist motors with one or a combination of the following systems.
 - a. Conductor-Collector System: Supply power by enclosed copper conductors mounted on a runway track and on a trolley track by means of phenolic insulator blocks and conducting bar brackets. Provide sliding shoe type collectors that provide positive contact with the conductor and permit high-speed operation without causing damage to the system.
 - b. Festooned System: Supply power by a flat wire festooned system consisting of multi-conductor flat cable attached to trolleys supported by a rigid track.
4. Size conductors for 125 percent full-load nameplate current of the largest motor and full-load currents of all additional motors, but in no case less than No. 12 AWG. Do not use a grounded transformer circuit to eliminate one conductor in any crane system.

5. Provide motors for hoist, trolley and bridge drives designed for intermittent reversing crane duty in accordance with the applicable section(s) of NEMA MG-1. Provide totally enclosed non-ventilated (TENV), squirrel cage rotor, NEMA design ["B"], permanently lubricated ball bearing, class [F] insulation motors with variable frequency drive. Provide motors rated for full operation for [30] minutes without exceeding an allowable motor temperature raise of 60 degrees C above an ambient temperature of 40 degrees C at 7500 feet elevation.
6. Provide motor controls that comply with the requirements of NEMA and Underwriter's Laboratories Inc., UL 508.
7. Provide an adjustable frequency drive (stepless) infinite variable speed control system for control of all crane motions. Monitor and adjust frequency and voltage of electrical power going to the motors with a microprocessor incorporated in the adjustable frequency drive control system. Control braking electronically with the adjustable frequency drive control system. Equip the adjustable frequency drive control system with self-diagnostics that monitor the electrical and electronic components of the control system and motors.
8. Control crane motions from the floor by 1 pendant control station. Arrange the pendant control station by functionally grouping buttons or as shown on the Drawings. Provide a pendant not to exceed [4] inches in width or depth.
 - a. Provide control buttons, except as noted below, with elevated ring type guards with recessed push buttons.
 - b. Provide push buttons of spring return momentary contact type with a concave or high-friction surfaces and a positive sense of control actuation. Provide buttons with an activation force resistance of 10-40 ounces, and a displacement of 1/8 inch minimum.
 - c. Provide push buttons with a minimum 3/4 inch diameter. Separate buttons with a space of at least 1/2 inch, with 2 inches preferred.
9. Permanently marked push button functions, (sticky tape is not an acceptable marking). Provide labels with black letters on a light background and upper case in style. Provide letters with a minimum of 1/8 inch in height.
10. Provide the pendant station with the following special controls in addition to the controls required for bridge, trolley and hoist control:
 - a. Emergency stop function, activation disconnects the power to the mainline contactor. Provide an emergency stop button larger in size than the other control buttons, red in color and unguarded for rapid activation.
 - b. Reset function, activation restores power after the emergency Stop button has been activated.
 - c. Rotary Lockout Control Switch, disables controls when placed in the "safety" switch position.
 - d. Speed Control Potentiometer, provides infinitely variable speed control from zero to maximum speed for each of the controlled functions.

11. Provide a pendant control station suspended and supported by a restraint cable from a torque reel balancer in such a manner that the electrical conductor does not carry the weight of the pendant station and so that the pendant hangs vertically. Provide vertical adjustment of the pendant station from 3'-4" to 7 foot above finish or operating floor. Design torque reel that works on the principal of a window shade, whereby the operator must make a deliberate motion to raise or lower the pendant station.

PART 3 EXECUTION

3.1 FABRICATION

- A. Fabricate the crane in accordance with approved shop drawings and manufacturer's data.

3.2 SHIPPING

- A. Protect, pack, identify, and ship crane components to the job site.

3.3 EXAMINATION

- A. Examine and verify the areas and conditions under which the crane equipment is to be installed, by the manufacturer. Bring unsatisfactory conditions to the immediate attention of LANL for correction prior to any installations activities.

3.4 INSTALLATION

- A. Install the crane in the location shown on the Drawings and in accordance with the approved shop drawings. Install the crane under the supervision of the manufacturer's representative.

3.5 SOURCE QUALITY CONTROL

- A. Perform all on and off-site quality control, inspection, testing, and reporting in accordance with this specification and established quality assurance plans. Submit a Quality Assurance Plan prior to fabrication.
- B. Quality Control: The manufacturer is responsible for the performance of all inspection requirements at the factory and or place of assembly (Off-site assembly only). Document inspections performed on the crane systems during fabrication in a report to LANL. Perform following inspections:
 1. Inspection of Steel Castings, Hooks and Welds: Employ an independent testing laboratory, approved by LANL, for the inspection of all steel castings, hooks and welds of each crane system. Conform to the following frequency for welds, 100 percent of full penetrating, 75 percent of all fillet welds. Use the magnetic particle method, ASTM A275, for testing metal parts or other methods approved by LANL.
 2. Welding: Prepare a welding procedure for all welding work and inspection in accordance with AWS.

3. Off site modifications: Provide a separate Quality Plan for work performed after shipment.

3.6 INSPECTION AND TESTING

- A. Notify the LANL Construction Inspector at least 14 days prior to beginning any testing. LANL will be present during all tests.
- B. Factory Tests: Test, prior to shipment from the factory, hoisting and lowering functions of all hoists (controls inclusive) at all speeds with no load, 50 percent and 100 percent of the rated load capacity.
- C. Field Test: Conduct testing under the supervision of a service engineer representing the manufacturer. Conduct the following field tests:
 1. Operational Tests:
 - a. Test crane systems, following installation but prior to acceptance, to ensure compliance with this specification and the contract documents. Test the crane functions of hoisting and lowering, operation of brakes, travel limit switches, and all safety devices. Trip setting of limit switches and safety devices at no-load conditions initially. Conduct tests at first by hand, if practical, and then under the lowest speed obtainable. Continue testing until all systems are tested under no-load conditions through the full range of motion and speed attainable by the crane. Test crane to determine that the hoists, including hooks and pendants are electrically grounded during all phases of hoist operation.
 2. Overload Tests:
 - a. After the operational tests, test functions of the crane systems at 125 percent of the rated load. Each crane system will be operated through its complete range of movements at this overloaded condition. Adjust the hoist overload cutoff to 125 percent of the rated load during the overload test and reset to 105 percent after the overload testing is complete.
- D. Inspection: LANL will perform a formal crane inspection for compliance with this specification prior to final acceptance of the crane installation.

3.7 ADJUSTMENT AND REPAIRS

- A. Correct any unsafe conditions disclosed by the inspection and tests prior to final acceptance by LANL. After completion of any adjustments or repairs, repeat pertinent field tests until the crane systems are approved by LANL. LANL will decide which field tests are applicable.

3.8 TRAINING

- A. Supply to LANL a [8] hour training session on the installed equipment. Cover operations and maintenance requirements.

END OF SECTION

Do not delete the following reference information:

FOR LANL USE ONLY

This project specification is based on LANL Master Specification 41 2213 Rev. 0, dated January 6, 2006.